

Claims

1. A metal part and other surface modification and cleaning method, in which the part to be treated is placed within a first vessel which is filled with a fluid, which flows through the first vessel located at a distance from the surface of said part and drains from the first vessel, with fluid flow rates controlled to pressurize the first vessel to increase the collapsing impact force of the cavitation bubbles, which in turn applies a peening effect to the surface of the part to strengthen and clean the surface of the treated part.

2. A metal part and other surface modification and cleaning method, in which the part to be treated is placed within a first vessel, which is filled with a fluid, and said first vessel is placed within a second vessel, which is filled with a fluid, to generate cavitation injecting pressurized fluid from a nozzle to generate cavitation, said nozzle separated from said part surface so that the collapsing impact force of the cavitation bubbles may be used to strengthen and clean the surface of the treated part by applying a peening effect to the surface of the part.

3. A metal part and other surface modification and cleaning method according to Claim 2 above, in which the first vessel is pressurized by controlling the flow rates of both fluids flowing into and out of said first vessel 1 to increase the collapsing impact force of the cavitation bubbles and to strengthen and clean the treated part by applying a peening effect under such impact force.

4. A metal part and other surface modification and cleaning method according to Claim 2 or 3 above, in which a substance with different acoustic impedance is inserted between said first and second vessels.

5. A metal part and other surface modification and cleaning method according to ant one of Claims 2 through 4, in which the fluid in said first vessel has its temperature controlled

by controlling the temperature of the fluid that fills the space between said first and second vessels.

6. A metal part and other surface modification and cleaning method according to either one of Claims 1 through 5 above, in which the cavitating jet to be injected into said first vessel is sent to the cooling means from said first vessel 1 and returned to a cavitating jet pump after being cooled in said cooling means.

7. A metal part and other surface modification device composed of a first vessel capable of accommodating the part to be treated, a lid hermetically enclosing said first vessel, a second vessel capable of accommodating said first vessel, a nozzle to inject a pressurized fluid into the pressurized fluid, a flow rate control valve to control the jet pressure from said nozzle and a pressure control valve to control the fluid pressure in said first vessel.

8. A metal part and other surface reforming device according to Claim 7 above, in which two or more of said nozzles are provided

9. A metal part and other surface modification device according to any one of Claims 6 through 8 above, in which said second vessel is configured to have a larger depth than a height of said first vessel.

10. A metal part and other surface modification device according to any one of Claims 6 through 9, in which a substance with different acoustic impedance is arranged between said first and second vessels.

11. A metal part and other surface modification device according to any one of Claims 6 through 9 above, in which the lid on said first vessel is closed with a specified force.

12. A metal part and other surface modification device according to any one of Claims 6 through 11 above, in which a means of heating or cooling the fluid in said second vessel is provided.

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13. A metal part and other surface modification device according to any one of Claims 6 through 12 above, in which said part to be treated is loaded on a carriage means to carry such part to be treated.

5 14. A metal part and other surface modification and cleaning method, in which a first vessel, which is filled with a fluid, is placed on a part to be treated and the fluid is introduced into said first vessel to pressurize the first vessel interior, with the collapsing impact force of the cavitation bubbles increased by injecting the pressurized fluid to generate cavitation in said first vessel so that said impact force may be used to treat, strengthen and clean the surface of the part by applying a peening effect to the part.

10 15. A metal part and other surface modification and cleaning method, in which the part to be treated is placed within a first vessel which is filled with a fluid, which is in turn introduced into said first vessel to pressurize said first vessel in the interior, with the collapsing impact force of the cavitation bubbles increased by injecting the pressurized fluid to generate cavitation in said first vessel so that said impact force may be used to treat, strengthen and clean the surface of the part by applying a peening effect to the part.

15 16. A metal part and other surface modification and cleaning device equipped with a first vessel placed on the part to be treated, with a nozzle to inject a pressurized fluid into said first vessel, and with a nozzle to inject a cavitating jet into the pressurized fluid in said first vessel to strengthen and clean the surface of the part to be treated by applying a peening
20 effect to the surface of the part under the collapsing impact force of the cavitation foam.

17. A metal part and other surface modification and cleaning device according to Claim 16 above, in which such device is an integral part of said first vessel, a nozzle to introduce a pressurized fluid into said first vessel, and a nozzle to inject a cavitating jet into the pressurized fluid in said first vessel.

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18. A metal part and other surface modification and cleaning device according to either Claim 16 or 17 above, in which such device is so configured as to control the pressure of the fluid in said first vessel by such a fluid pressure regulator means as a valve or the like.

5 19. A metal part and other surface modification and cleaning device according to any one of Claims 16 through 18 above, in which said part to be treated is immersed in the fluid in a second vessel.

20. A metal part and other surface modification and cleaning device according to Claim 19 above, in which said part to be treated is placed above the surface of the fluid filled in said second vessel.

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21. A metal part and other surface modification and cleaning device according to any one of Claims 7 through 20 above, in which a means of cooling the cavitating jet fluid to be introduced into said first vessel is provided.

22. A metal part and other surface modification and cleaning device according to any one of Claims 16 through 21, in which a pressurized fluid is poured into said first vessel as if it surrounded the cavitating jet fluid.

23. A metal part and other surface modification and cleaning method, in which the part to be treated, such a pipe-shaped part or conduit and the like, has a fluid-pressurizing chamber formed within the pipe or conduit to inject a cavitating jet into such pressurized fluid and to increase the collapsing impact force of the cavitation bubble so that the internal
20 surface of the pipe may be strengthened and cleaned by using such impact force to apply a peening effect to the internal surface of the pipe.

24. A metal part and other surface modification and cleaning device equipped with first and second members to form a fluid-pressuring chamber in a pipe or conduit, with a nozzle to pour a pressurized fluid between said first and second members, and with a nozzle
25 to inject a cavitating jet into said fluid pressurizing chamber, to strengthen and clean the

surface of the treated part by using the collapsing impact force of the cavitation foam to apply a peening effect to the surface of the part.

25. A metal part and other surface modification and cleaning device according to Claim 24 above, in which either said first member or said second member is provided with a fluid pressure regulator means to regulate the fluid pressure in the fluid-pressurizing chamber.

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